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LOW LEVEL LASER THERAPY AND ITS HIGH END APPLICATIONS IN DENTISTRY – A REVIEW

SARASWATHI GOPAL. K[1] & NAVEEN KUMAR. B[2]

[1] *Professor & Head, Department of Oral Medicine & Radiology, Meenakshi Ammal Dental college & Hospital, Chennai, Tamil Nadu, India*

[2] *Post graduate Trainee, Department of Oral Medicine & Radiology, Meenakshi Ammal Dental college & Hospital, Chennai, Tamil Nadu, India*

ABSTRACT

These unique characteristic makes the Laser useful for commercial and medical application. An understanding of the optimal therapeutic effect results when the wavelength best absorbed by the target tissue is selected for use, However the choice of the best laser for certain procedure depends on much more than just matching emission spectra of Laser to absorption spectra of tissue. The versatility of the instrument combined with latest achievement in Laser technology, compact design and affordability should appeal to dental professional seeking to optimize the procedure they currently perform and expand the number of service they offer. Taking into consideration the effects of the laser treatment, such as activation of microcirculation, production of new capillaries and thickening of the capillary net, anti-inflammatory, analgesic effect, stimulated growth and regeneration of cells, and accelerated bone consolidation, following the need for incorporating non-invasive methods for minimizing the pain and discomfort either during or after dental treatment, we consider that the use of Low level laser therapy is an excellent treatment option.

KEYWORDS: Spectra of Tissue, Anti-Inflammatory, Analgesic Effect, Stimulated Growth

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INTRODUCTION

Most dentists will be familiar with the wide range of lasers that are used in modern dentistry. Dental lasers function by producing waves of photons (quanta of light) that are specific to each laser wavelength. This photonic absorption within the target tissue results in an intracellular and/or intercellular change to produce the desired result. Dental lasers may be separated into two basic groups: High Level Laser nm to and Low level Laser therapy. High Level Laser will be used in spectrum of 810nm – 10600nm. Chromophore refers to the substance or quality within a specific target tissue that serves as an attractant for a laser photon. This photonic absorption within a target tissue's chromophore is the basis for a dental laser's functional dynamic process, referred to as a laser/tissue interaction.

The therapy performed with such low energy (Watt) lasers is often called Low Level Laser Therapy (LLLT). Other terms that may be encountered to describe these are soft laser, low intensity level laser, cold laser, and low-power laser. [(1-3)]Additionally the treatments or therapy have also been referred to as laser biostimulation, biomodulation and photo biomodulation. These therapeutic lasers generally operate in the visible (red) and the infrared spectrum, 600-900 nm wavelength.[(2,3)]

MECHANISM INVOLVED IN THE ACCELERATION OF WOUND HEALING BY LLLT

The beneficial effect of LLLT on wound healing can be explained by considering several basic biological mechanisms including the induction of expression cytokines and growth factors known to be responsible for the many phases of wound healing. (Figure 1)

- Laser increased both protein and mRNA levels of IL-1 and IL-8 in keratinocytes. These are cytokines responsible for the initial inflammatory phase of wound healing.
- It can up regulate cytokines responsible for fibroblast proliferation and migration such as bFGF, HGF and SCF.
- It can increase growth factors such as Vascular Endothelial Growth Factor responsible for the neovascularization necessary for wound healing.
- TGF is a growth factor responsible for inducing collagen synthesis from fibroblasts and has been reported to be upregulated by LLLT.
- It can induce fibroblasts to undergo the transformation into myofibloblasts, a cell type that expresses smooth muscle actin and desmin and has the phenotype of contractile cells that hasten wound contraction.

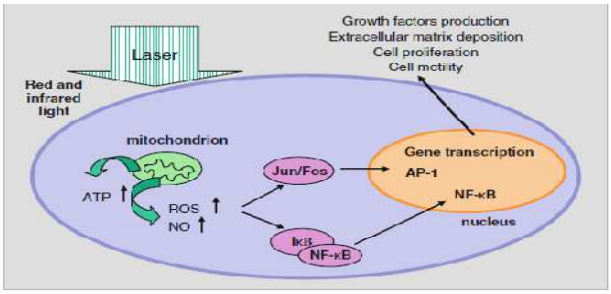

Figure 1: LLLT – Intra Cellular Mechanism of Action

There are three main classifications of treatment outcomes for LLLT [6]

- To improve would repair (including iatrogenic wounds) and preventing cell and tissue death;
- To reduce inflammation and oedema in an existing condition (caused by an injury or chronic disease)
- Analgesia plus some other neurological conditions.

So LLLT is suitable for any aspect of dentistry that can benefit for one or more of these outcomes. LLLT is effective in reducing or removing pain from many causes. Surgical discomfort for example can be reduced by irradiating the area post treatment before the local anesthesia wears off. [7]

APPLICATION IN DENTISTRY

- **Dentinal Hypersensitivity**

Dentinal hypersensitivity can be successfully treated with LLLT. In fact, LLLT has been more effective than the traditional Stannous Fluoride (SnF2) regime. Low level laser irradiation of exposed root dentine tubules has been shown to prevent demineralisation without causing any adverse thermal side effects. The potential benefits of LLLT also include improved healing, reduced inflammation and pain control, which suggest considerable potential for its use in oral tissues.[8]

- **Post Surgical Wound Healing**

Wound healing is a complex process with local and systemic responses and involves several types of cells, enzymes, growth factors and other substances. The use of low level laser therapy for wound healing has been shown to be effective in modulating local and systemic responses. In studies of fibroblast responses to lasers, increased cell division and increased collagen production have been reported. However, it is possible that low level laser therapy effects on wound healing depend not only on the total dose of irradiation but also time and mode)[(9)]

Application of LLLT immediately following the removal of third molars provides the most comfortable postoperative quality of life for the patient by reducing trismus, reducing swelling and reducing pain. Many studies have shown the benefits to healing on wounds resulting from various surgical procedures.[(10)] This combines with the beneficial effects of reduced an oedema and pain reduction. Extraoral LLLT is more effective than intraoral LLLT for the reduction of post operative trismus and swelling after extraction of the lower third molar, including faster bone repair after tooth extraction.[(11)] Superpulsed laser irradiation may be a treatment of choice for patient sscheduled for tooth extraction, as it provides clinical efficacy, is safe and well tolerated, and is able top revent inflammation.

Treatments for Myogenic Cases:

Treatments for myogenic cases typically involve LLLT to muscular insertionsand trigger points while arthritic cases the treatment is more directly associated with the joint area. Studies have reported significant reductions in symptoms in almost all cases and improvedfunctioning in many especially myogenic disorders. [(12)]There was a significant increase in the pressure pain threshold of the examined muscles. There was also a significant decrease in pain bypalpation after laser exposure. LLLT is hence effective at relieving pain but does not provide physical improvement. [(12)]

LOW-LEVEL LASER THERAPY IN ORAL LESIONS

HSV 1 (Herpes Simplex) both oral and perioral has been successfully treated with LLLT with best results when treatment is in the early prodromal phase. Results include an immediate reduction in pain levels with blisters disappearing in a few days. As Laser helps to reduce viral count and also act on the neural tissue. Zosters and postherpetic neuralgia may also be treated. LLLT also reduces the frequency of recurrence and relapse rate. [(13)]

Cancer therapy induced mucositis is a debilitating condition that has been difficult to treat. Its shown that LLLT can significantly reduce pain, severity and the duration of symptoms inpatients and can partly prevent the development of the condition and promotes the healing phase. Many envisage that LLLT will soon become part of routine oral supportive care in cancer.[(14)]

LLLT has also been shown to be effective in relieving pain and reducing the healing time during the treatment of aphthous ulcers,. Many authors report the therapy as being extremely effective.[(15)]

The treatment regime has also been suggested as an adjunct to treatment to a number of other conditions that are traditionally difficult to effectively treat. These include oral lichen planus, oral and cutaneous pemphigus vulgaris, denture stomatitis, and burning mouth syndrome.[(15)]

LOW LEVEL LASER THERAPY (LLLT) AND NEURAL TISSUES

Following LLLT, neural tissues show reduced synthesis of inflammatory mediators, as well as more rapid

maturation and regeneration, particularly axonal growth. Consistent with this, positive reports of the benefit of LLLT used in the dental office to treat disorders including trigeminal neuralgia, and muscular pain have been presented. LLLT has proven to be very effective when applied to "trigger points" i.e., myofascial zones of particular sensibility and of highest projection of focal pain points, due to ischaemic conditions.(16)

LLLT USES IN TEMPOROMANDIBULAR JOINT DISORDERS

Based on the results of experimental studies and therapeutic evaluations, LLLT is suggested in the management of TMD through its analgesic, anti inflammatory and biostimulation effects. TMJ sounds were not affected after treatment in any of the studies. This was anticipated, since joint sounds commonly originate from mechanical disruption of the joint, and is not expected to be influenced by conservative measures. There is a comparative study compared laser and microcurrent electrical stimulation (MENS) in another study where laser was found to be more effective in pain and mouth opening parameters.(17)

LLLT USED TO REDUCE NAUSEA

The useful and risk-free point on the wrist, known by acupuncturists as the meridian point P 6. Three to four Joules on this point reduces gagging reflexes in most patients. Application of LLLT of point p 6 before dental procedure such as taking impression reduces the sense of nausea.(18)

RISKS, SIDE EFFECTS AND CONTRAINDICATIONS

The only risk in laser therapy is the potential for eye damage. Direct light beams have the most potential for harm but reflected light should also be considered. While never reported to have occurred, the risk of eye damage must be considered. Regarding eye protection, wearing of protective eyewear by the patient and others in the treatment area, particularly for extra oral therapy in the face is recommended. In fact, ocular damage from LLLT is extremely low with some animal studies suggesting therapeutic healing effects by LLLT on the eye. (5)Since the therapeutic lasers are well above the ionizing spectrum there is no risk of cancerous changes.(19)

CONCLUSIONS

Low level laser therapy has been found to accelerate wound healing and reduce pain, possibly by stimulating oxidative phosphorylation in mitochondria and modulating inflammatory responses. LLLT exerts marked effects upon cells in all phases on wound healing, but particularly so during the proliferative phase.

The effect is specific for wavelength, and cannot be gained efficiently with normal, non-coherent, non-polarized light sources, such as LEDs. Future trials of new LLLT applications in dentistry should make use of standardized, validated outcomes, and should explore how the effectiveness of the LLLT protocol used may be influenced by wavelength, treatment duration, dosage, and the site of application.

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